DELAYED RECOVERY FROM ROCURONIUM BLOCK IN AN INFANT

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Abstract

Prolonged duration of action of rocuronium in an infant patient is rare. We report an unusual case of prolonged neuromuscular blockade with rocuronium in an infant undergoing cleft lip repair anesthetized with sevoflurane and management of the patient.

Keywords: Infant, rocuronium, sevoflurane.

Introduction

Prolongation of the actions of rocuronium in an infant has not been described previously. We report a case of unusually prolonged neuromuscular blockade with rocuronium in an infant undergoing cleft lip repair anesthetized with sevoflurane.

Case

Otherwise healthy six months old boy weighing 7.4 kg scheduled for cleft lip and palate repair surgery was admitted to the theatre without premedication. After routine monitoring with ECG, non-invasive blood pressure, pulse oximeter and skin temperature, anesthesia induction and endotracheal intubation was performed with sevoflurane, nitrous oxide in 50% oxygen, 0.6 mg/kg (4.5 mg.) of rocuronium and 2 µg/kg of fentanyl. Anesthesia was maintained with sevoflurane (2.5%–4%) and nitrous oxide in oxygen. No further rocuronium was given. Mechanical ventilation was set at 8 ml/kg with a suitable rate to achieve an $ETCO_2$ of 35 mmHg. The uneventful surgical procedure was completed after 122 min (134 min after induction). The lungs were then ventilated manually and sevoflurane was discontinued. Approximately 5 min later despite neurologic and hemodynamic signs of waking, the patient showed no signs of spontaneous ventilation or movement. Neuromuscular block monitoring was commenced. Train-of-four (TOF) stimulation of the left ulnar nerve at the wrist and recording of the response of the thumb was performed using acceleromyography (TOF-Watch®, Organon, Dublin, Ireland). Initial recordings revealed no signs of recovery. Light general anesthesia with sevoflurane together with mechanical ventilation was restarted to avoid any hazards or patient discomfort. The first response to TOF stimulation was recorded 223 min after the intubating dose of rocuronium and first reversal dose of neostigmine (0.04 mg/kg) plus atropine (0.02 mg/kg) was given. The second response appeared 18 min later

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(241 min after injection of rocuronium). At this time, a second reversal dose of neostigmine (0.04 mg/kg) was administered and sevoflurane was discontinued. Sufficient recovery (TOF ratio > 0.9) was reached 9 min later, and the trachea was extubated when the patient was awake. The infant was awake and crying on arrival at the post-anesthetic care unit.

Discussion

Several factors may have contributed to the prolonged duration of action of rocuronium in this patient.

First, the patient was suspected of an accidental high dose of rocuronium. We re-checked the drug doses and excluded the possibility of an overdose. Individual patient variability such as genetic trait, age, hypothermia and concomitant drugs may be other factors responsible for prolonged neuromuscular block. Cleft lip and palate patients are considered to be more prone to muscular diseases[1]. Rocuronium is known to cause prolonged neuromuscular block in muscular dystrophies such as Duchenne dystrophia[2]. We ruled out this possibility after detailed family history and obtaining a postoperative normal plasma creatine kinase result of 146 U/L (normal range: 20-240 U/L). Hypothermia prolongs the time-course of action of non-depolarizing neuromuscular blocking agents. The monitored skin temperature was warmer than 34°C during the procedure and the patient was not receiving drugs known to interfere with neuromuscular blockade.

Previous data from randomized studies indicate sevoflurane as the possible cause[3,4]. Sevoflurane is known to enhance neuromuscular block produced by rocuronium, decreasing the requirement for the relaxant and affecting the recovery of the neuromuscular transmission[5,6]. There is evidence that the younger the patient, the more variability the action of rocuronium. Woloszczuk et al[7] have shown that this potentiating effect of sevoflurane is a result of pharmacodynamic rather than pharmacokinetic interaction with rocuronium. During the study conducted with children, Woloszczuk et al observed that in some children, neuromuscular transmission failed to return to values preceding rocuronium administration until sevoflurane administration was discontinued[7]. In our case we continued sevoflurane administration until sufficient recovery was recorded by acceleromyography. This may have contributed to the delayed recovery.

Sugammadex is the first line drug for difficult recovery from rocuronium block. Sugammadex encapsulates rocuronium and can reverse even deep block in less than 3 min and can be use in children[8]. Although present in our market, because it was not supplied immediately we were not able to use sugammadex. If it was available, most probably the neuromuscular block could have been antagonized at the end of the surgery.

We can not comment further on the contribution of sevoflurane anesthesia to delayed recovery from rocuronium block in infants depending on a single case report. Further research will eventually clarify all the factors associated with delayed neuromuscular function recovery caused by non-depolarizing drugs in infants and children. Until then, enhancement by sevoflurane of neuromuscular block produced by rocuronium remains as the plausible explanation for the present case.

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